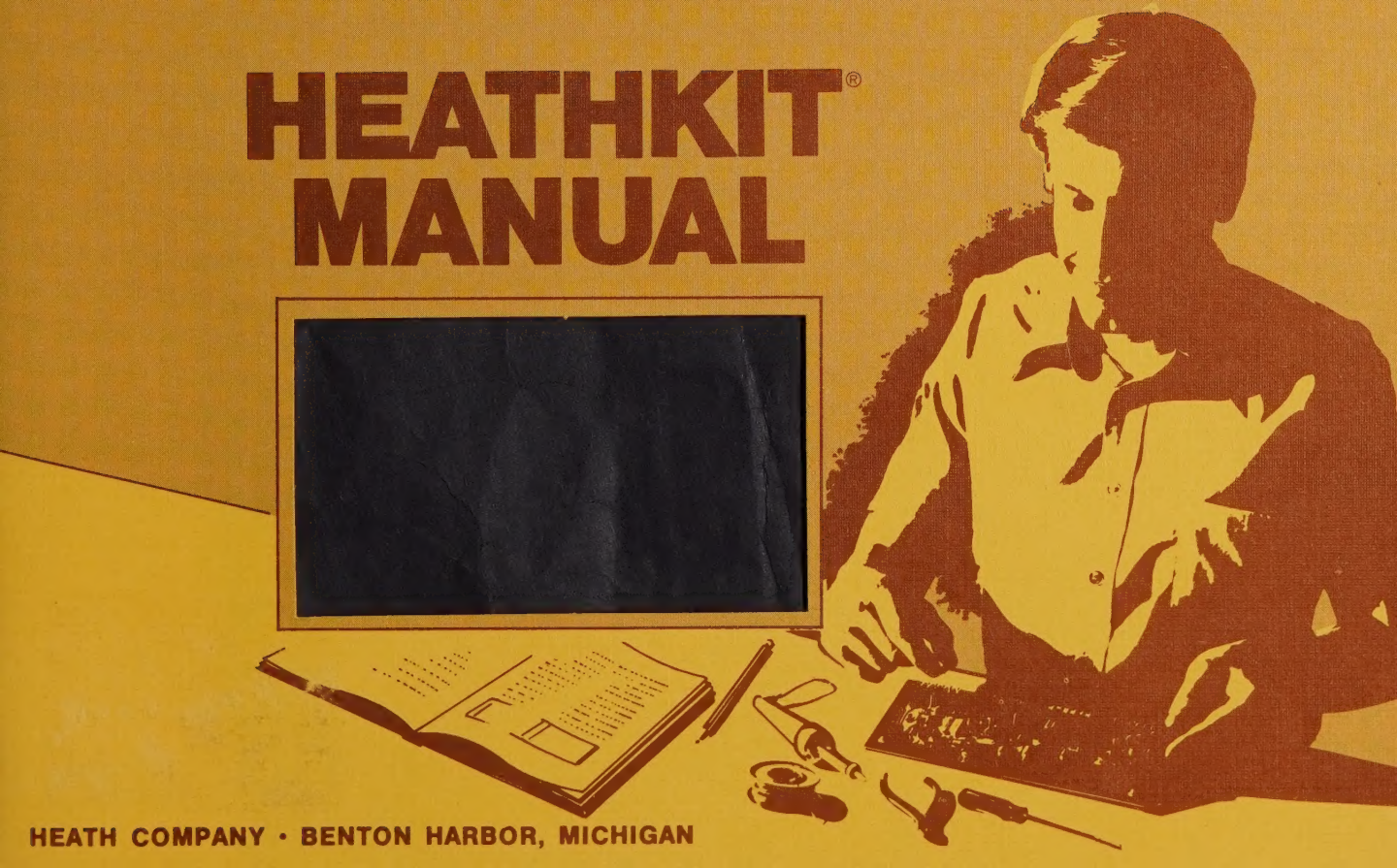
HEATHKIT® MANUAL



HEATH COMPANY • BENTON HARBOR, MICHIGAN

YOUR HEATHKIT 90-DAY LIMITED WARRANTY

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by: incorrect assembly, the use of corrosive solder, defective tools, misuse, or fire; or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for inconvenience, loss of use, customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for accidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

If you are not satisfied with our service (warranty or otherwise) or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

HEATH COMPANY
BENTON HARBOR, MI. 49022

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information	(616) 982-3411
Credit	(616) 982-3561
Replacement Parts	(616) 982-3571

Technical Assistance Phone Numbers
8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

R/C, Audio, and Electronic Organs	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Weather Instruments and Home Clocks	(616) 982-3315
Television	(616) 982-3307
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Computers	(616) 982-3309

Prices and specifications subject to change without notice.

Heathkit® Manual

for the

MICODER™ II

Model HD-1984

595-1963-01

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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PARTS LIST

Check each part against the following list. The key numbers correspond to the numbers in the Parts Pictorial. Any part that is packed in an individual envelope should be returned to the envelope after you identify it. Keep these parts in their envelopes until they are called for in the assembly steps. Do **NOT** throw away any packing until you account for all the parts.

Each circuit part in this kit has its own "Circuit Component Number" (R104, C102, IC101, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of this Manual. These numbers, which are especially useful if a part has to be replaced, appear:

— In the Parts List;

— At the beginning of each step where a component is installed;

— In some illustrations;

— In the Schematic;

— In the sections at the rear of this Manual.

To order a replacement part, always include the Part Number. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

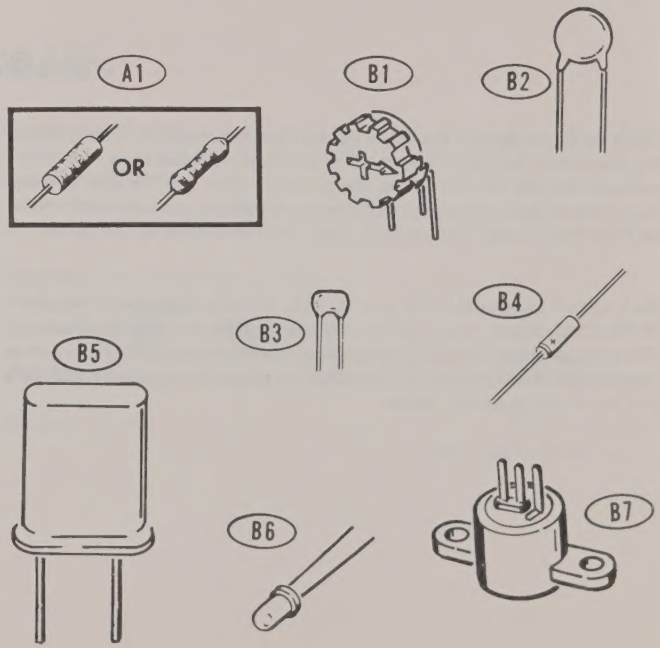
RESISTORS, 1/4-Watt

NOTE: The following resistors have a tolerance of 10% unless otherwise noted. 10% is indicated by a fourth color band of silver; 5% is indicated by a gold fourth band.

A1	6-100-12	1	10 Ω (brown-black-black)	R105
A1	6-821-12	1	820 Ω (gray-red-brown)	R102
A1	6-222-12	1	2200 Ω (red-red-red)	R108
A1	6-472-12	1	4700 Ω (yellow-violet-red)	R106
A1	6-103-12	1	10 kΩ (brown-black-orange)	R104
A1	6-223-12	1	22 kΩ (red-red-orange)	R107
A1	1-50-12	1	11 MΩ, 5% (brown-brown-blue)	R101

OTHER ELECTRONIC PARTS

B1	10-990	1	1000 Ω (1 kΩ) control	R103
B2	21-3	1	10 pF ceramic capacitor	C101
B3	21-182	1	.047 μF (473) ceramic capacitor	C102
B4	25-197	1	1 μF tantalum capacitor	C103
B5	404-578	1	3563.795 kHz (3.563795 MHz) crystal	Y101
B6	412-79	1	LED lamp (TIL209)	LED101
B7	480-71	1	Microphone	



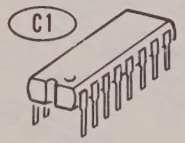
KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

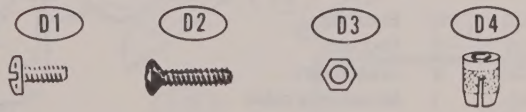
INTEGRATED CIRCUIT (IC)

CAUTION: The IC can be damaged by static electricity. Do not remove the IC from its conductive carrier until you are instructed to do so in a step.

NOTE: The integrated circuit may be marked for identification in one of the following four ways:

1. Part number.
2. Type number. (This refers only to the numbers, the letters may be different or missing.)
3. Part number and type number.
4. Part number with a type number other than the one listed.





C1	442-638	1	MK5086	IC101

HARDWARE

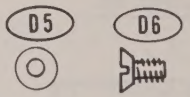
#4 Hardware

D1	250-52	2	4-40 × 1/4" screw
D2	250-1233	4	4-40 × 7/16" black oval head screw
D3	252-15	4	4-40 hex nut
D4	252-192	6	4-40 self-retaining nut

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

Other Hardware

D5	253-94	4	#3 flat washer
D6	250-416	1	6-32 × 1/4″ flat head screw

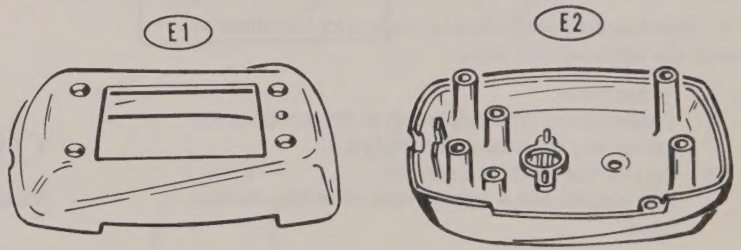


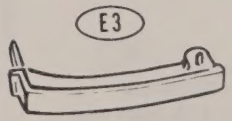
WIRE-CABLE

	344-125	12″	Black wire
	344-127	6″	Red wire
	344-128	6″	Orange wire
	347-59	1	Microphone cable

MOLDED PARTS

E1	95-620	1	Case top
E2	95-621	1	Case bottom
E3	95-622	1	PTT switch actuator





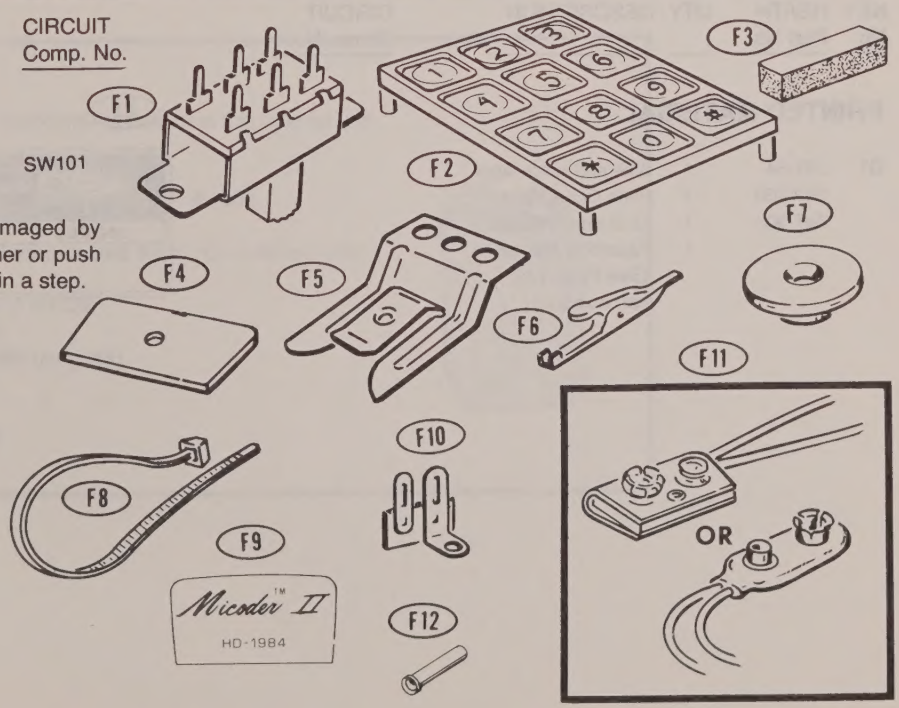
KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

MISCELLANEOUS

F1	60-72	1	Slide switch	SW101

CAUTION: The keyboard (#64-780) can be damaged by rough handling. Do **NOT** remove it from its container or push any of its buttons until you are instructed to do so in a step.

F2	64-780	1	Keyboard
F3	73-64	1	1/2" × 2" battery cushion
	75-108	1	Insulating paper
	85-2019-2	1	Encoder circuit board
F4	205-1664	1	Decorative plate
F5	260-33	1	Microphone clip
F6	260-53	1	Alligator clip
F7	266-884	1	Hanger button
F8	354-5	1	Cable tie
F9	390-1350	1	Decorative label
F10	431-57	1	Terminal strip
F11	432-798	1	Battery connector
F12	432-932	8	Pin socket
			Solder

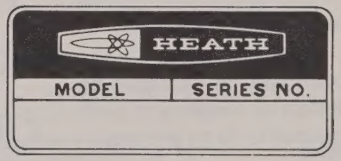


KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

PRINTED MATERIAL

G1	391-34	1	Blue and white label
	597-260	1	Parts Order Form
	597-308	1	Kit Builder's Guide
		1	Assembly Manual (See Page 1 for part number.)

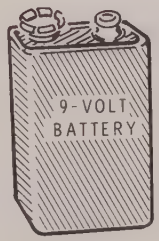
G1



BATTERY

You should purchase the following battery at this time for use in your kit:

One 9-volt transistor battery, NEDA #1604.



Representative manufacturers and their type numbers are:

Eveready #216 or #1222
Mallory #M1604
Mallory #TR-146X (long life)
Burgess #2V6
RCA #VS323
Hellesens #410
Varta #438

ASSEMBLY NOTES

IMPORTANT: Before you begin to assemble this kit, be sure to read the information in the "Kit Builder's Guide."

1. When you perform the steps in the circuit board Pictorials, position each part as shown. Follow the instructions carefully and read the entire step before you perform each operation.

2. Due to the small foil area around some of the circuit board holes and the small area between the foils, use the utmost care to prevent solder bridges between adjacent foils. Use only a minimum amount of solder and a small tip soldering iron of not over 25 watts. Allow the iron to reach operating temperature; then apply it only long enough to make a good solder connection. If you think a solder bridge may exist, but you are not sure, compare the foil on the circuit board with the "Circuit Board X-Ray View" in the rear of this Manual.

3. To eliminate a solder bridge; hold the circuit board above the soldering iron and reheat the solder. As the solder melts; it will flow down the iron.

4. If your work surface is smooth, place the circuit board on a cloth to prevent it from sliding around when you solder component leads to the foil.

5. Resistors will be called out by their resistance value in Ω (ohms), kΩ (1000 ohms) or MΩ (1,000,000 ohms).

6. Capacitors will be called out by their capacitance value in pF (picofarad) or μF (microfarad) and type (ceramic).

SAFETY WARNING: Avoid eye injury when you clip off excess lead lengths. Hold the leads so they cannot fly toward your eyes.

CIRCUIT BOARD ASSEMBLY

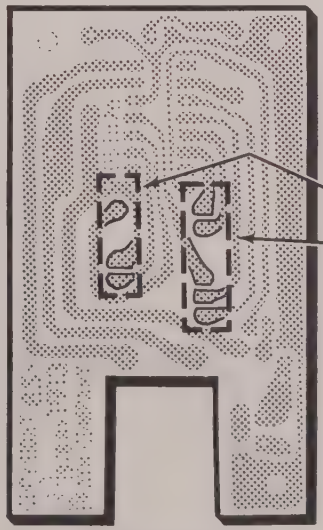
START

One side of the circuit board has part outlines printed on it. This side will be called the "**printed side.**" The dashed part outlines indicate the parts that will be installed on the other side, called the "**foil side,**" of the circuit board.

Mount all parts **close** to the circuit board. When you solder a lead to the foil, be careful that you do not bridge across to another foil.

Solder the leads to the foil as you install each part and cut off the excess lead lengths.

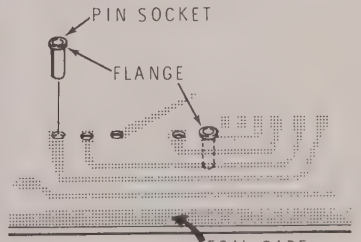
(✓) Position the circuit board as shown with the **foil side** up.



PICTORIAL 1-1

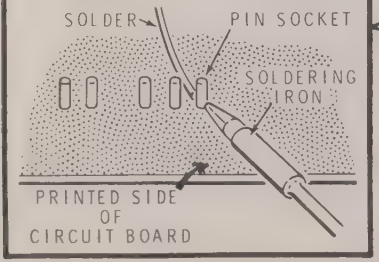
CONTINUE

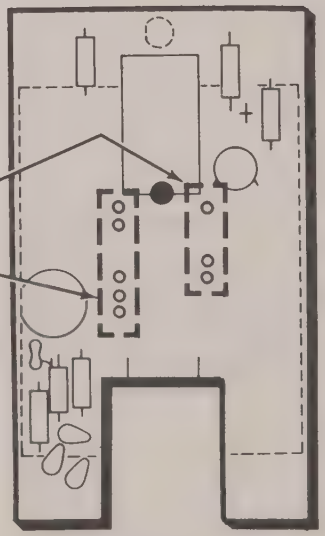
(✓) Install eight pin sockets (#432-932). Push each socket through the circuit board hole from the **foil side**. Make sure the flange of each pin socket is down against the foil.



START

(4) Turn the circuit board over. Then solder each pin socket to the printed side of the board. NOTE: The solder will be drawn into the "plated through" holes. Do NOT cut these sockets off on the printed side of the circuit board.





PICTORIAL 1-2

START

( ) Position the circuit board as shown with the printed side up.

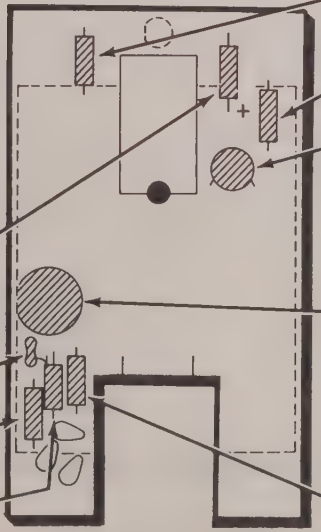
NOTE: When you install tantalum capacitors, be sure to match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board as shown.

( ) C103: 1 μF tantalum.

( ) C102: .047 μF (473) ceramic.

( ) R106: 4700 Ω (yellow-violet-red).

( ) R104: 10 kΩ (brown-black-orange).



PICTORIAL 1-3

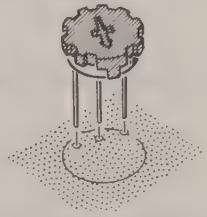
CONTINUE

( ) R102: 820 Ω (gray-red-brown).

( ) R101: 11 MΩ (brown-brown-blue).

( ) C101: 10 pF ceramic. Lay this capacitor down against the circuit board.

( ) R103: 1000 Ω (1k) control. First bend the control leads at a right angle to the control. Then insert the leads into the holes within the outline for the control.

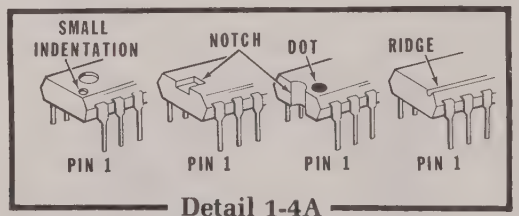


( ) R105: 10 Ω (brown-black-black).

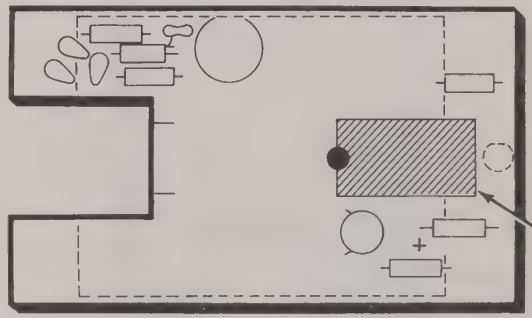
START

NOTE: The integrated circuit that you will install in the next step is a rugged and reliable component. However, normal static electricity discharged from your body through an integrated circuit pin to an object can damage the integrated circuit. Read the instruction first. Then carefully perform each step without interruption.

1. Remove the IC from its package with both hands.
2. Hold the IC in one hand, remove the conductive carrier, and straighten any bent pins with the other hand.
3. Continue holding the IC, being careful not to touch it to anything, while you pick up and hold the circuit board in your other hand.



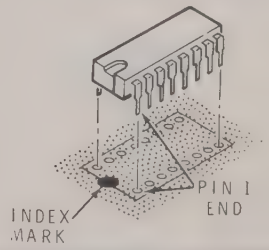
Detail 1-4A



PICTORIAL 1-4

CONTINUE

4. Refer to Detail 1-4A and locate pin 1 of the IC. Then install the IC so pin 1 is inserted into hole 1 on the circuit board. Make sure all of the IC pins go through the circuit board before you solder the pins to the foil.



(✓) IC101: MK5086 IC (#442-638).

START

NOTES:

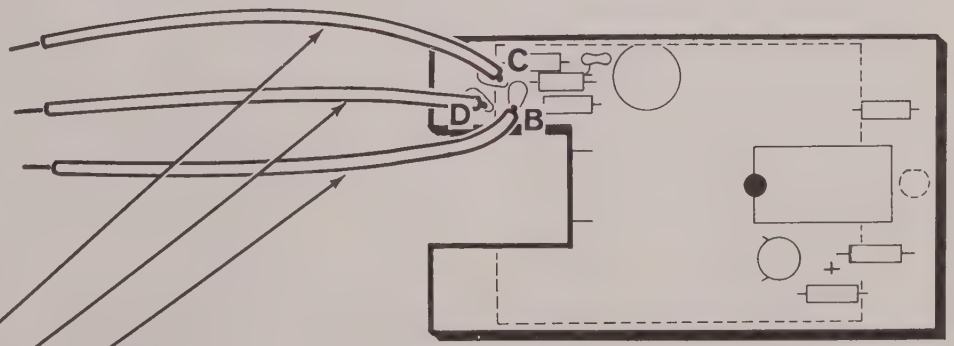
1. To prepare a wire, as in the next step, cut the wire to the indicated length and remove 1/4″ of insulation from each end. Then twist the strands together and melt a small amount of solder on the bare wire ends to hold the strands together. Solder each wire as it is connected.

2. Only one end of each wire will be connected at this time.

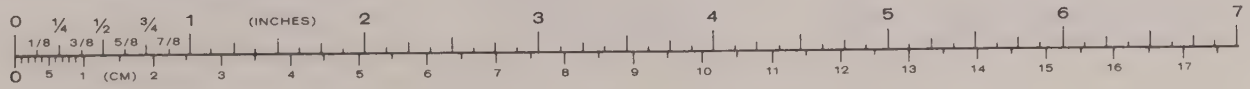
(✓) 3″ red wire to C.

(✓) 3″ black wire to D.

(✓) 3″ orange wire to B.



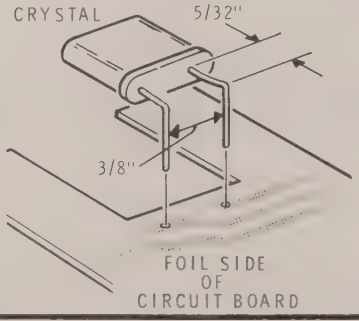
PICTORIAL 1-5

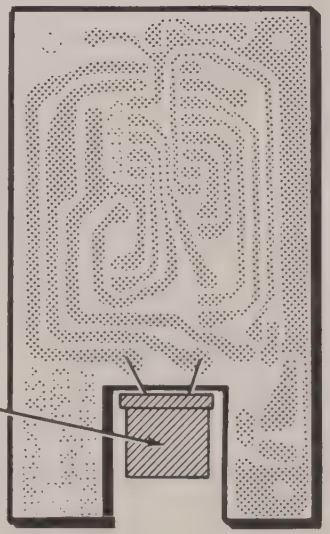


START

( ) Position the circuit board as shown with the foil side up.

( ) Y101: 3563.795 kHz (3.563795 MHz) crystal (#404-578). First bend each lead at a right angle 5/32" from the bottom of the crystal. Use long-nose pliers. Then bend the leads apart so there is a 3/8" spacing between them. Carefully insert the leads into the circuit board holes. Be sure the 5/32" section of each lead is against the foil side of the circuit board before you solder the leads to the foil.

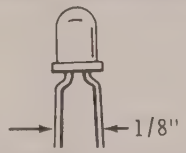




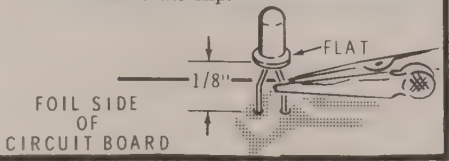
PICTORIAL 1-6

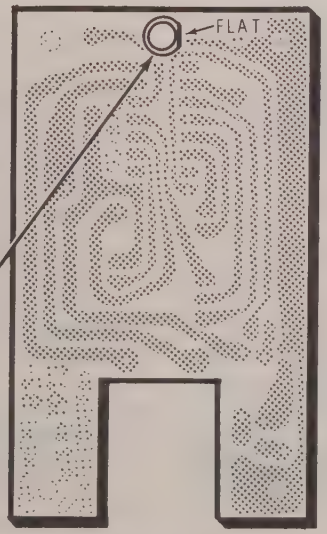
START

NOTE: Before you install the LED (#412-79), form both leads as shown. Use long-nose pliers. Do **NOT** apply any stress to the leads where they enter the LED body.



( ) LED101: Position the flat on the LED as shown in this Pictorial. Insert the leads of the LED into their holes. Clip the alligator clip onto one of the LED leads as shown below. Make sure the LED base is spaced 1/8" above the circuit board. Then solder this lead to the foil on the **printed** side of the board. Move the clip to the other lead and similarly solder the lead to the foil. Remove and discard the clip.





PICTORIAL 1-7

CONTINUE

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following most commonly made errors.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

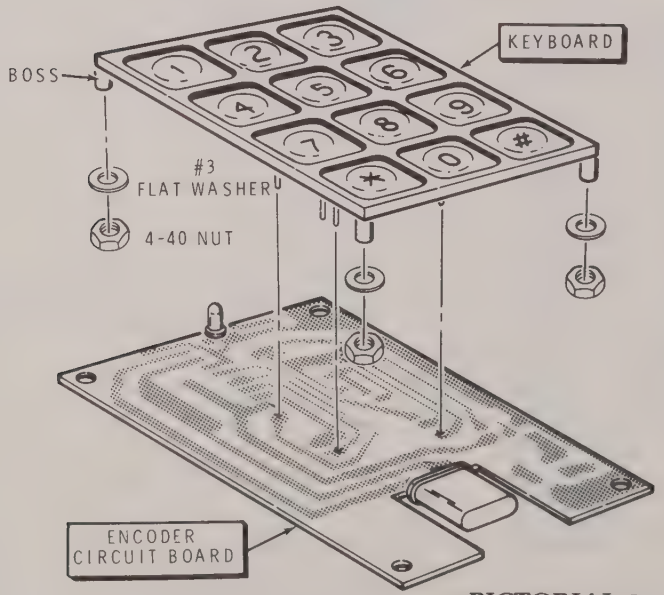
( ) Protruding leads. No lead should be longer than 1/16". NOTE: Do **NOT** cut the eight pin sockets off on the printed side of the circuit board.

( ) Integrated circuit for the proper **installation.**

( ) Tantalum capacitor for the correct position of the positive (+) mark.

(√) LED lamp for the correct position of the "flat side."

KEYBOARD INSTALLATION



PICTORIAL 2-1

Refer to Pictorial 2-1 for the following steps.

CAUTION: Do **NOT** push any of the keyboard buttons until you have completed the next three steps.

( ) Remove the keyboard (#64-780) from its container.

( ) Install a #3 flat washer on one of the keyboard bosses. Then, using a pair of long-nose pliers, start a 4-40 nut on this boss to form threads. Carefully tighten the nut. Do **NOT** overtighten, as you may strip the threads.

( ) Similarly, install a #3 flat washer and a 4-40 nut on each of the three remaining bosses.

( ) Position the keyboard and encoder circuit board as shown. Then insert the keyboard pins into the proper pin sockets on the circuit board. Be sure the keyboard bosses are pressed tightly down against the circuit board.

( ) Set the circuit board assembly aside until it is called for in a step.

CASE BOTTOM ASSEMBLY

Refer to Pictorial 2-2 (Illustration Booklet, Page 1) for the following steps.

( ) Position the case bottom as shown in the Pictorial.

( ) Install a 4-40 self-retaining nut at B. Position the nut with the slotted end pointing down as shown. Then, using the plastic handle of a screwdriver, carefully press the nut down into the boss until it is flush with the top of the boss.

( ) In the same manner, install a self-retaining nut in each of the remaining five bosses in the case bottom at C, D, E, H, and J.

NOTE: Perform the next step only if the three microphone lugs do **NOT** line up with the two small tabs in the rubber mount as shown in the Pictorial.

( ) Carefully push the microphone out of the rubber mount with your fingers. Line up the three microphone lugs with the two small tabs in the rubber mount. Then carefully push the microphone back into the rubber mount.

( ) Install the microphone at F. Make sure lug 3, connected to the metal case, is positioned as shown. Push the small tabs over the studs in the case bottom. Then push the microphone down so it is properly seated in hole F.

Refer to Detail 2-2A for the next three steps.

( ) Use diagonal cutters to cut off the narrow portion of each of the six lugs on the slide switch.

( ) Prepare the 2-lug terminal strip by bending the lugs up as shown.

NOTE: In the following step, make sure you install the slide switch so the lever is toward boss E.

( ) SW101: Install the prepared slide switch at SW101. Use a 4-40 × 1/4" screw at E and the prepared 2-lug terminal strip and a 4-40 × 1/4" screw at D.

NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following the "S" tells how many wires are at the connection.

( ) Prepare a 3" black wire.

( ) Connect the 3" black wire from the microphone lug 3 (S-1) to terminal strip D lug 1 (NS).

( ) R108: Connect a 2200 Ω (red-red-red) resistor from the microphone lug 2 (S-1) to terminal strip D lug 2 (NS). Push lug 2 of the microphone towards switch SW101 to avoid interference with the other microphone lugs.

( ) R107: Connect a 22 kΩ (red-red-orange) resistor from the microphone lug 1 (S-1) to switch SW101 lug 4 (NS). NOTE: Make sure the resistor leads do not short to the metal switch case or the other resistor.

Refer to Pictorial 2-3 (Illustration Booklet, Page 2) for the following steps.

NOTE: Be careful that you do not accidentally burn the insulation on any leads when you solder the leads to the lugs of switch SW101 in the following steps.

( ) Refer to Detail 2-3A and prepare the battery connector leads as shown.

( ) Connect the black battery connector lead to terminal strip D lug 1 (NS).

( ) Route the red battery connector lead under the terminal strip as shown in the Pictorial. Then connect the lead to switch SW101 lug 5 (S-1).

( ) Refer to Detail 2-3B and prepare end A of the microphone cable as shown. NOTE: First remove the foil wrapping; then remove the black wrapping from the white wire.

( ) Melt a **small** amount of solder on each wire end to hold the fine strands together.

Connect end A of the microphone cable as follows:

( ) Connect the shield lead to terminal strip D lug 1 (S-3).

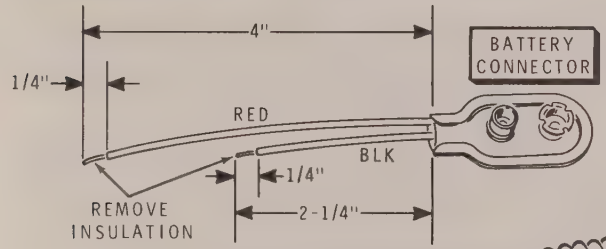
( ) Route the white lead under the terminal strip as shown in the Pictorial. Then connect the lead to terminal strip D lug 2 (S-2).

( ) Connect the black lead to switch SW101 lug 1 (S-1).

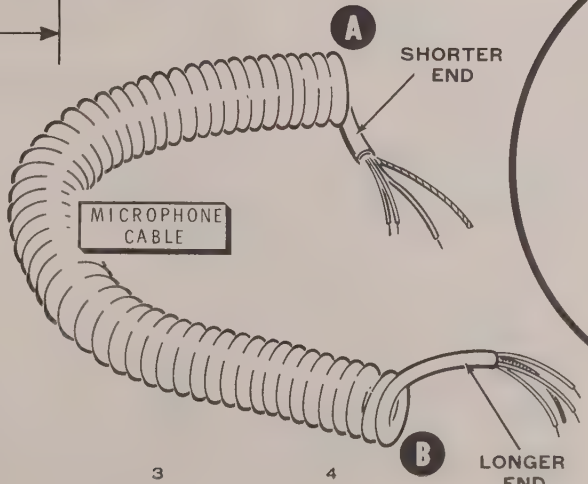
( ) Connect the red wire to switch SW101 lug 2 (S-1).

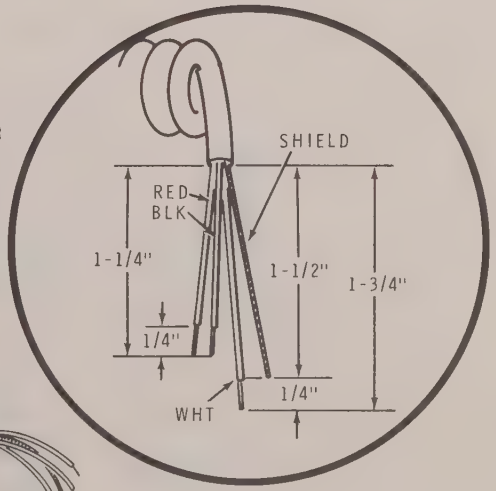
( ) Cut the 1/2" × 2" battery cushion in half with a pair of scissors.

( ) Remove the protective paper backing from only one side of each half of the battery cushion. Then press both halves onto the inside of the case bottom at the location shown.

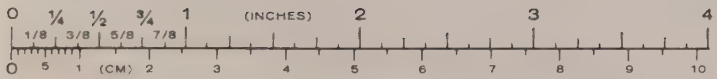


Detail 2-3A





Detail 2-3B



Refer to Pictorial 2-4 for the following steps.

( ) Locate the prewired encoder circuit board.

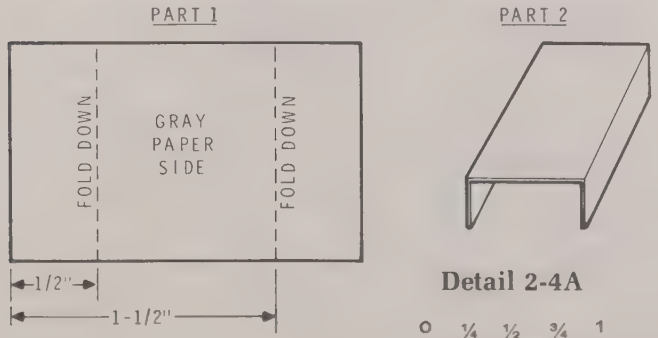
Connect the free ends of the wires coming from the encoder circuit board as follows:

( ) Black wire to terminal strip D lug 1. Use the eyelet of lug 1 (S-1).

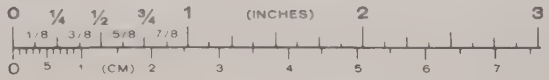
( ) Red wire to terminal strip D lug 2. Use the eyelet of lug 2 (S-1).

( ) Orange wire to switch SW101 lug 4 (S-2).

( ) Plug the battery connector onto the 9-volt battery (not supplied).



Detail 2-4A



( ) Install the battery in the case bottom as shown in the Pictorial.

( ) Twist the three wires coming from the encoder circuit board together by turning the board three full turns.

( ) Refer to the inset drawing on the Pictorial and pass a cable tie around the microphone cable at the location shown. Position the cable as shown. Then pull the cable tie snug and clip off the excess length of the tie.

( ) Refer to Part 1 of Detail 2-4A and prepare the insulating paper as shown.

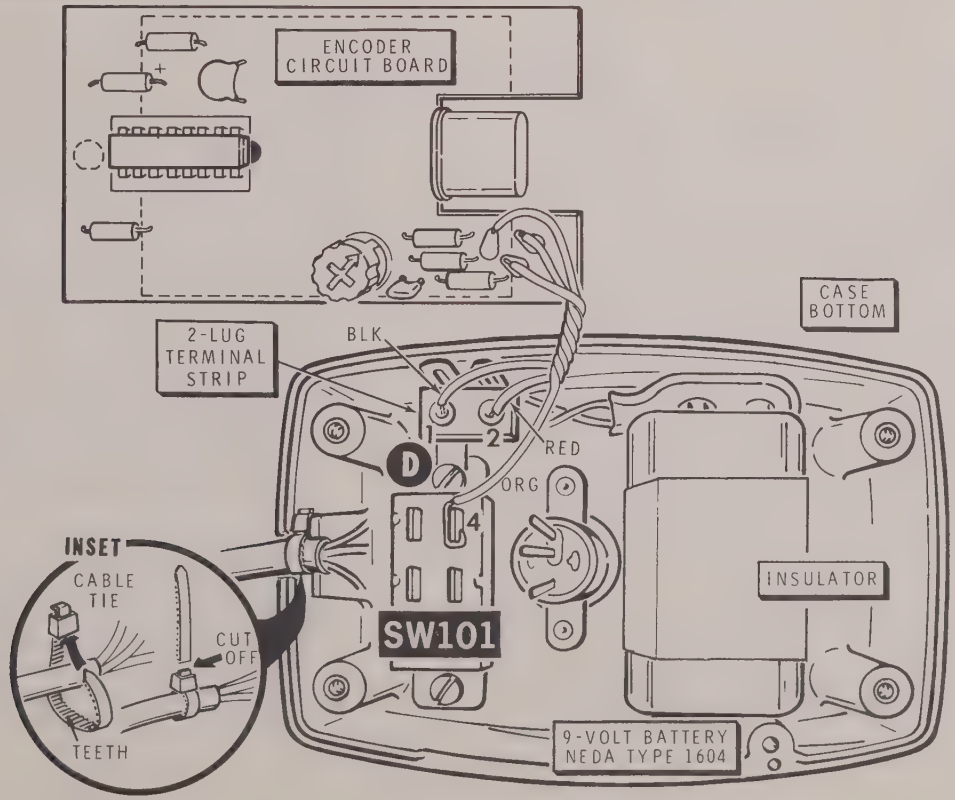
( ) Score the paper on the gray side along the dotted lines at the two locations marked "fold down."

NOTE: When you perform the next step, make sure the backing paper is on the inside.

( ) Bend the paper along the dotted lines and form an insulator as shown in Part 2 of Detail 2-4A.

( ) Position the insulator over the battery as shown in the Pictorial.

This completes the "Case Bottom Assembly." Proceed to "Typical Transceiver Installation" on Page 27. Then continue with "Level Adjustment" on Page 24.



PICTORIAL 2-4

LEVEL ADJUSTMENT

Refer to Pictorial 3-1 for the following steps.

( ) Temporarily push the encoder circuit board through the rectangular hole in the case top as shown.

NOTE: Hole K, referred to in the next step, is the inner hole.

( ) Position the PTT switch actuator so its pivoting pin rests in hole K. Make sure the other end of the actuator is positioned as shown in the inset drawing. Then place the case top over the assembly. Be sure the top is seated properly on the case bottom. Then temporarily install two 4-40 × 7/16" oval head screws in opposite corners as shown. Do **NOT** tighten these screws.

( ) Turn control R103, on the encoder circuit board, to midrange.

( ) Turn your transceiver on.

( ) Depress the Micoder PTT switch actuator.

( ) Check to see that the LED lamp on the encoder circuit board lights when any of the keyboard buttons is pushed.

The LEVEL control will now be adjusted to insure that the transmitted signal is properly modulated when you are using the Micoder.

NOTE: You may find it helpful to place a rubber band around the case halves to keep the PTT switch actuator depressed while you make adjustments in the following steps. Remove the rubber band when you are instructed to release the actuator.

Use one of the following methods, listed in the order of accuracy, to adjust the level controls in your transceiver and the Micoder.

1. ( ) While you speak into the Micoder microphone, adjust the transmitter LEVEL control for 4.5 to 5 kHz of FM deviation using a deviation monitor meter. Then, while you key the transmitter and at the same time push the "#" sign on the encoder keyboard, adjust the Micoder LEVEL control (R103) for 4.3 to 4.8 kHz of FM deviation. NOTE: Increase the deviation by turning control R103 in the direction shown on Pictorial 3-1.

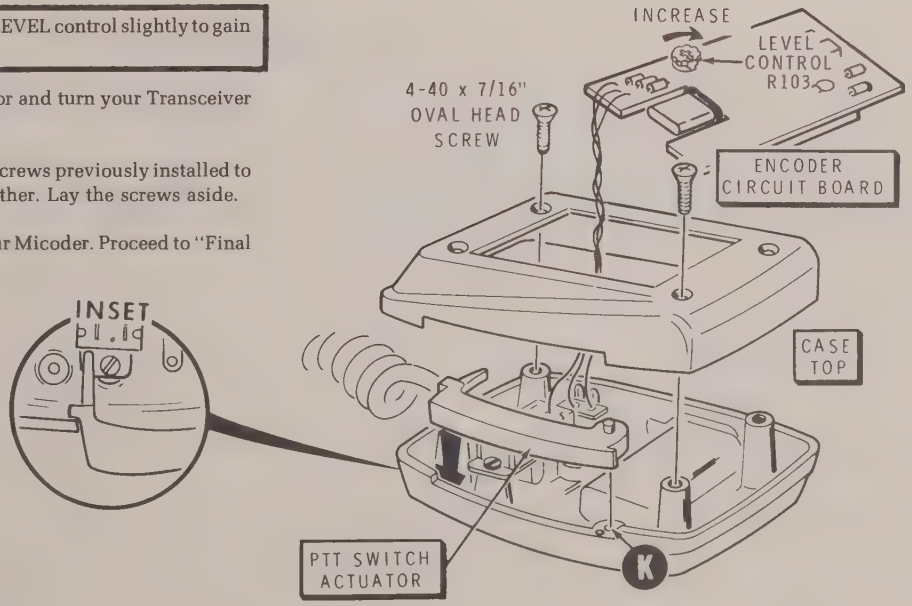
2. ( ) If a deviation monitor meter is not available, use on-the-air checks with other amateur operators. Check with three or four stations to get a consensus of opinion on the recaptured audio in their receivers. While you speak into the Micoder microphone, adjust the **transmitter** LEVEL control. Then, while you key the transmitter and at the same time push the "#" sign on the encoder keyboard, adjust the Micoder LEVEL control (R103) until they say your deviation is correct.

NOTE: You may have to readjust the Micoder LEVEL control slightly to gain access to the auto patch.

( ) Release the Micoder PTT switch actuator and turn your Transceiver off.

( ) Remove the two 4-40 × 7/16" oval head screws previously installed to hold the case top and case bottom together. Lay the screws aside.

This completes the "Level Adjustment" of your Micoder. Proceed to "Final Assembly."



PICTORIAL 3-1

FINAL ASSEMBLY

You can install either a hanger button or a decorative label on the Micoder case bottom. This is a matter of personal preference. Both the hanger button and the decorative label are supplied. Refer to the appropriate set of instructions given below. NOTE: If you plan to use your Micoder with a transceiver in a mobile installation, you may want to install the hanger button so you can hang the Micoder in the microphone clip (supplied) when you are not using your transceiver.

Refer to Pictorial 4-1 (Illustration Booklet, Page 3) and the associated Detail for the following steps.

HANGER BUTTON

( ) Refer to Detail 4-1A for the following steps.

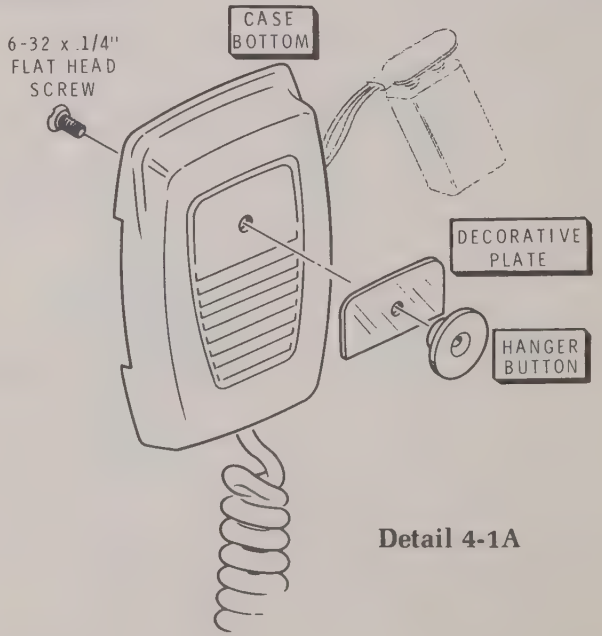
( ) If the decorative plate is supplied with a protection paper backing, remove the backing from the plate.

( ) Mount the hanger button at F with the decorative plate and a 6-32 × 1/4" flat head screw.

DECORATIVE LABEL

( ) Remove the protective paper backing from the decorative label.

( ) Refer to Detail 4-1B and press the label into place on the case bottom.



Detail 4-1A

Complete the assembly of your Micoder by completing the following steps in the sequence listed.

1. ( ) Push the encoder circuit board down against the bosses in the case bottom. Hold the circuit board in place with one finger.

2. ( ) Position the PTT switch actuator as shown in the Pictorial.

3. ( ) Position the microphone cable so the outer insulation rests in the U-shaped groove in the case bottom.

4. ( ) Place the case top over the encoder circuit board and onto the case bottom.

5. ( ) Secure the case top to the case bottom with four 4-40 × 7/16" oval head screws.

( ) Carefully peel away the paper backing from the blue and white label. Then press the label onto the cover of this Manual.

TYPICAL TRANSCEIVER INSTALLATION

( ) Refer to the chart below and identify the leads at the free end of the microphone cable.

( ) Refer to the proper section in the transceiver manual and connect each of the above leads to the proper location.

MICROPHONE CABLE LEAD	CONNECTION
RED	CONTROL CIRCUIT (GROUNDING)
WHITE	AUDIO
BLACK	GROUND
SHIELD	GROUND

IN CASE OF DIFFICULTY

The first part of this section of the Manual titled "Visual Tests," describes what to do about the difficulties that may occur right after your unit is assembled.

If the "Visual Tests" fail to clear up the problems, or if difficulties occur after your unit has been in use for some time, read the following information and then refer to the "Troubleshooting Chart."

VISUAL TESTS

1. About 90% of the kits that are returned to the Heath Company for service do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are soldered as described in the "Kit Builder's Guide."

2. Closely examine each circuit board foil in a good light to see that no solder bridges exist between adjacent connections. If available, use a magnifying glass for this purpose. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil pattern against the "Circuit Board X-Ray View" on Page 33.

3. Check each capacitor value. Be sure that a capacitor of correct value is installed at each capacitor location.

4. Check each resistor value carefully. Be sure in each step that the proper part has been wired into the circuit, as shown in the Pictorial Diagrams.

5. Be sure all wires and leads connected to the circuit board have been trimmed as close as possible to the circuit board foils.

6. Try to analyze the symptoms of any problem you may have before starting any troubleshooting procedure. A review of the "Circuit Description" may also help you determine where the trouble is.

If the trouble is still not located after the "Visual Tests" are completed, and a voltmeter is available, check voltage readings against those shown on the "Schematic Diagram." Read the "Precautions for Troubleshooting" before you make any measurement. NOTE: All voltage readings were taken with a high input impedance voltmeter. Voltages may vary as much as ±10%.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service Information" inside the rear cover of this Manual. Your Warranty is located inside the front cover.

PRECAUTIONS FOR TROUBLESHOOTING

CAUTION: Be very careful when you measure voltages so you do not damage circuit board components.

1. Be sure you do not short any adjacent foils when you make voltage measurements. If the probe should slip, for example, and short together two adjacent connections, it is very likely to damage the integrated circuit. Although this component has an almost unlimited life when used properly, it is much more vulnerable to damage from excessive voltage or current than other parts.

Troubleshooting Chart

The following chart lists the "Condition" and the "Possible Cause" of some malfunctions. If a particular part is mentioned as a possible cause, check that part to see if it is incorrectly wired or installed improperly. Also check to see if an improper part was installed at that location. It is also possible, on rare occasions, for a part to be faulty.

CONDITION	POSSIBLE CAUSE
No tone frequencies are produced when any keyboard button is being pushed.	1. Y101 defective. 2. IC101 installed backwards or defective. 3. R103 is turned to minimum or defective.
Single tone or no tone frequencies are produced when a particular keyboard button is being pushed.	1. Keyboard defective.
LED lamp does not light when any keyboard button is being pushed.	1. Solder bridge at IC101 pin 10. 2. LED101 installed backwards or defective. 3. Low battery voltage.
PTT switch does not function properly.	1. Wiring of the microphone circuit in your transceiver. 2. Wiring of the microphone cable.
No microphone output, but encoder output O.K.	1. Wiring of the microphone element.
Short battery life.	1. Wiring shorted to the metal frame of the PTT switch.

SPECIFICATIONS

Operating Voltage	9.0 VDC.
Current Consumption	1 mA with PTT switch depressed. 20 mA with any keyboard button depressed.
Battery Life	Approximately 6 months.*
Output Level	30 mV rms maximum.
Output Load	10 kΩ minimum.
Frequency Tolerance	±1.5%.
Operating Temperature Range	−20° to 110° F. (−29° to + 43° C).
Total Distortion	< 5% (harmonic plus intermodulation).
Dimensions	3-3/4″ high × 2-5/8″ wide × 1-3/4″ deep (9.5 × 6.7 × 4.4 cm).
Weight	9 oz. (including battery). (250 g).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

*For continuous operation below +20°F (−7°C), we suggest that you use an alkaline or a nickel-cadmium battery.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram while you read the "Circuit Description."

Integrated circuit IC101 is the heart of the Audio Patch Encoder. Using a 3.563795 MHz crystal reference, IC101 provides seven different audio sinusoidal frequencies, which are mixed together to provide tones suitable for Dual-Tone Multi-Frequency (DTMF) telephone dialing.

As a keyboard button is being pushed, a positive voltage (+5.1 V) is applied to two of the input pins on IC101 (pins 3, 4, or 5 for high tones and pins 11, 12, 13, or 14 for low tones). The keyboard entries select the proper digital dividers to divide the 3.563795 MHz frequency to obtain the unique frequencies required. Further processing of these frequencies takes place in IC101 to produce the required dual-tone signal available at pin 16 of IC101.

The dual-tone signal is applied across control R103. A portion of this signal is filtered by resistors R104 and R106 and capacitor C102. A clean signal is then applied to the modulator stage in the transmitter.

When a keyboard button is being pushed, pin 10 of IC101 will go to a positive potential. The LED lamp will turn on, indicating that a dual-tone signal is being generated.

When the Micoder PTT switch is depressed, power is applied to the encoder circuitry and the microphone amplifier. At the same time, the transmitter circuits are enabled. Resistor R107 reduces the voltage applied to the microphone amplifier and resistor R108 isolates the microphone output from the encoder output.

The capacitor-type microphone element has an audio frequency amplifier built into it.

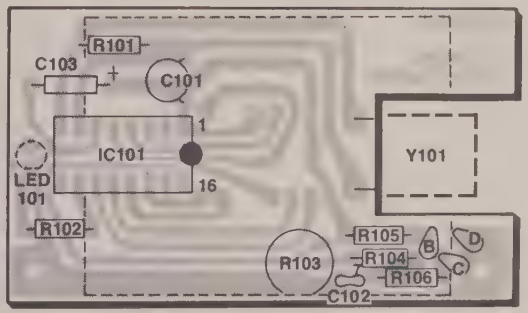
CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R105, C103, etc.) on the "Circuit Board X-Ray View."

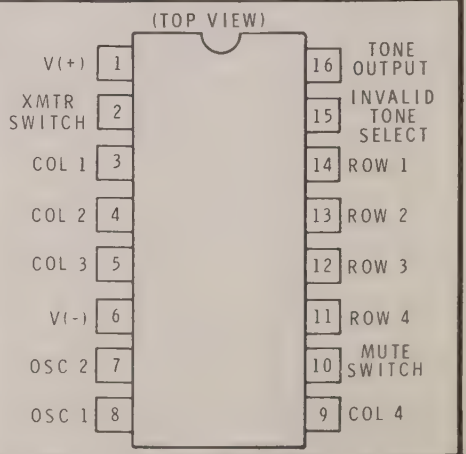
B. Locate this same number in the "Circuit Component Number" column of the "Parts List."

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION, which must be supplied when you order a replacement part.



(Viewed from component side)

SEMICONDUCTOR IDENTIFICATION CHARTS

COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
LED101	412-79	TIL209	
IC101	442-638	MK5086	 (TOP VIEW) V(+) 1 XMTR SWITCH 2 COL 1 3 COL 2 4 COL 3 5 V(-) 6 OSC 2 7 OSC 1 8 16 TONE OUTPUT 15 INVALID TONE SELECT 14 ROW 1 13 ROW 2 12 ROW 3 11 ROW 4 10 MUTE SWITCH 9 COL 4

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

SEND TO:

HEATH COMPANY
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only):
616 982-3571

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

Total enclosed $_____

- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

THIS FORM IS FOR U.S. CUSTOMERS ONLY — OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH COMPANY • BENTON HARB

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